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IS 4695-2 (2003): General Purpose Knuckle Threads, Part 2: Deviations and Tolerances [PGD 20: Engineering Standards]



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“Knowledge is such a treasure which cannot be stolen”

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सामान्य उद्देश्य के लिए नक्कल चूड़ियाँ
भाग 2 विचलन एवं छूटें
(दूसरा पुनरीक्षण)

Indian Standard
GENERAL PURPOSE KNUCKLE THREADS
PART 2 DEVIATIONS AND TOLERANCES
(*Second Revision*)

ICS 21.040.10

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Part 2) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Engineering Standards Sectional Committee had been approved by the Basic and Production Engineering Division Council.

This standard was first published in 1968 and subsequently revised in 1988. This revision has been taken up for updating this standard incorporating the developments taken place in the field at international level.

In the preparation of this standard assistance has been derived from DIN 405 - 2 : 1997 'General purposes knuckle threads — Part 2: Deviations and tolerances' issued by the Deutsches Institut für Normung (DIN).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GENERAL PURPOSE KNUCKLE THREADS

PART 2 DEVIATIONS AND TOLERANCES

(*Second Revision*)

1 SCOPE

This standard covers the deviation and tolerances for knuckle screw threads.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
1076	Preferred numbers:
(Part 1) : 1985	Series of preferred numbers (<i>second revision</i>)
(Part 2) : 1985	Guide to the use of preferred numbers (<i>second revision</i>)
(Part 3) : 1985	Guide to the choice of series of preferred numbers and series containing more rounded value of preferred numbers (<i>second revision</i>)
4695 (Part 1) : 2003	General purpose knuckle screw threads: Part 1 Profile and nominal sizes (<i>second revision</i>)

3 SYMBOLS AND TERMINOLOGY

For the purpose of this standard, the symbols and terminology as given in Table 1 of IS 4695 (Part 1) shall apply.

4 DESIGNATION

A complete designation of knuckle screw threads comprises a size designation and tolerance class designation.

4.1 The size designation of knuckle screw threads is specified in IS 4695 (Part 1).

4.2 The tolerance class designation of knuckle screw threads comprises a class designation for pitch diameter tolerance followed by a class designation for the crest diameter tolerance. Each class designation shall consist of the following:

- a) A figure indicating tolerance grade; and
- b) A letter indicating tolerance position, capital for nuts, small for bolts.

If the two class designations for a thread are equal, it is not necessary to repeat the symbol.

4.2.1 Example for Nut Thread

Thread size designation as specified in IS 4695 (Part 1)	$Rd\ 40 \times 4.233$	7H	6H
Class designation for pitch diameter tolerance			
Class designation for crest (minor) diameter tolerance			

4.2.2 Example for Bolt Thread

Thread size designation as specified in IS 4695 (Part 1)	$Rd\ 40 \times 4.233$	7h	6h
Class designation for pitch diameter tolerance			
Class designation for major diameter tolerance			

4.2.3 Example of Fits Between the Threaded Parts

$Rd\ 40 \times 4.233$	7H/ 7e
$Rd\ 40 \times 4.233$	7H/ 7h 6h

5 TOLERANCE GRADES

The tolerance grades for major, pitch and minor diameters shall be as given below:

Symbol	Diameters	Tolerance Grades	
D_1	Minor diameter of nut thread	6	7
d	Major diameter of bolt thread	6	7
d_3	Minor diameter of bolt thread	7	8
D_2	Pitch diameter of nut thread	7	8
d_2	Pitch diameter of bolt thread	6 ¹⁾ , 7	8
¹⁾ This tolerance grade is only needed for calculating the pitch diameter tolerance, T_{d2} of tolerance Grades 7 and 8.			

6 TOLERANCE POSITIONS

The tolerance positions for nut and bolt threads shall be as given at 6.1, 6.2 and 6.3.

6.1 Nut Threads

Tolerance position, H with basic allowance, $EI = 0$ (see Fig. 1).

6.2 Bolt Threads

Tolerance position, h with basic allowance, $es = 0$ (see Fig. 2) and tolerance position, e with negative basic allowance, es (see Fig. 3).

6.3 The basic allowances of the bolt thread shall be as given below:

Lead, P mm	External Threads d_1, d_2, d_3		Internal Threads D_2, D_1 Tolerance Position EI H
	Tolerance Position es		
	e μm	h μm	
2.54	-78	0	0
3.175	-85	0	0
4.233	-97	0	0
6.35	-120	0	0

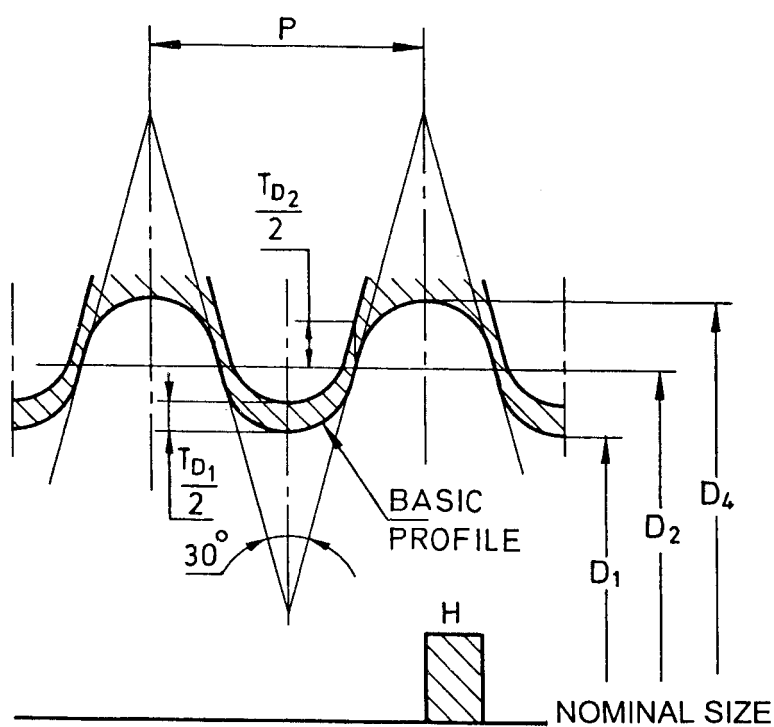


FIG. 1 NUT THREAD WITH BASIC ALLOWANCE, $EI = 0$
(TOLERANCE POSITION, H)

7 LENGTH OF THREAD ENGAGEMENT

The length of thread engagement are divided into two groups N (normal) and L (long) as given below:

Nominal Thread Diameter, d		Lead, P mm	Length of Thread Engagement for		
			N		L
Over mm	Up to mm		From mm	Up to mm	
7	12	2.54	9	25	25
12	20	3.175	12	35	35
20	38	3.175	13	39	39
38	72	4.233	20	59	59
72	100	4.233	22	67	67
100	150	6.350	36	107	107
150	200	6.350	39	116	116

8 TOLERANCE ON MAJOR AND MINOR DIAMETERS

8.1 Minor Diameter Tolerance, T_{D1} for Nut Threads

The tolerance on minor diameter tolerance, T_{D1} for nut threads shall be as specified below:

Lead, P mm	T_{D1}	
	Tolerance Grades	
	6 μm	7 μm
2.54	450	560
3.175	530	670
4.233	630	800
6.350	850	1 060

8.2 Major Diameter Tolerances for Nut Threads

For this diameter no tolerance has been specified.

8.3 Minor Diameter Tolerance, T_{d3} for Bolt Threads

The tolerance on minor diameter tolerance, T_{d3} for bolt threads shall be as specified below:

Nominal Thread Diameter, d		Lead, P mm	T_{d3}	
Over mm	Up to mm		Tolerance Grades	
			7 μm	8 μm
7	12	2.54	250	315
12	38	3.175	300	375
38	100	4.233	375	475
100	200	6.350	500	630

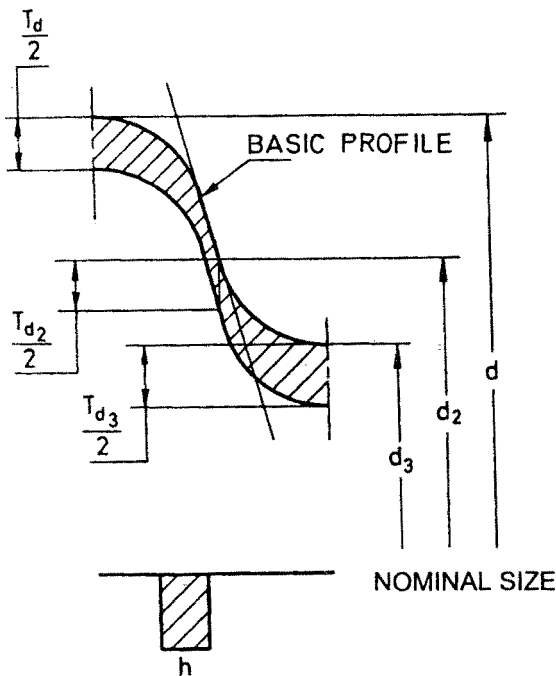


FIG. 2 BOLT THREAD WITH BASIC ALLOWANCE, $es = 0$
(TOLERANCE POSITION, h)

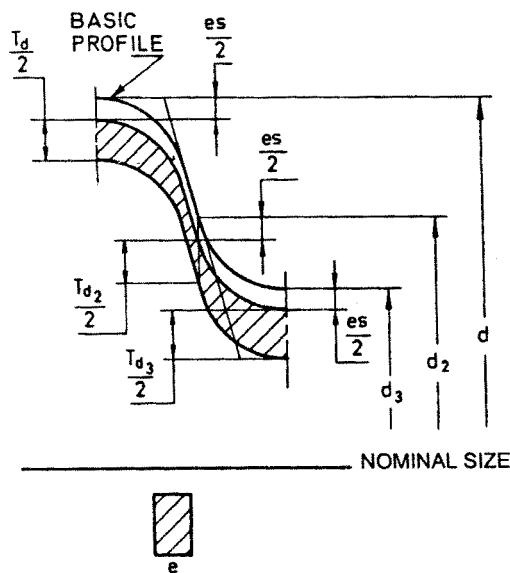


FIG. 3 BOLT THREAD WITH NEGATIVE BASIC
ALLOWANCE, es
(TOLERANCE POSITION, e)

8.4 Major Diameter Tolerance, T_d for Bolt Threads

The tolerance on major diameter tolerance, T_d for bolt threads shall be as specified below:

Lead, P mm	T_d	
	Tolerance Grades	
	6 μm	7 μm
2.54	335	425
3.175	375	475
4.233	475	600
6.350	630	800

9 PITCH DIAMETER TOLERANCES

9.1 Pitch Diameter Tolerance, T_{d2} for Bolt Threads

The pitch diameter tolerance, T_{d2} for bolt threads shall be as specified below:

Nominal Thread Diameter, d		Lead, P mm	T_{d2}		
			Tolerance Grades		
Over mm	Up to mm		6 μm	7 μm	8 μm
7	12	2.54	160	200	250
12	38	3.175	190	236	300
38	100	4.233	236	300	375
100	200	6.350	315	400	500

9.2 Pitch Diameter Tolerance, T_{D2} for Nut Threads

The pitch diameter tolerance, T_{D2} for nut threads shall be as specified below:

Nominal Thread Diameter, d		Lead, P mm	T_{D2}	
			Tolerance Grades	
Over mm	Up to mm		7 μm	8 μm
7	12	2.54	265	335
12	38	3.175	315	400
38	100	4.233	400	500
100	200	6.350	530	670

10 RECOMMENDED TOLERANCE ZONE

10.1 In order to reduce the number of gauges and tools, only the tolerance zones specified in 10.1.1 to 10.1.4 shall be adopted.

If the length of thread engagement is unknown, thread engagement group N is recommended.

To avoid confusions with previous tools, threading tools and gauges shall always be provided with the relevant tolerance zone.

10.1.1 Tolerances Zones for Pitch Diameter of Nut Threads

The tolerances zones for pitch diameter, D_2 of nut threads shall be as specified below:

Tolerances Zones for Pitch Diameter	
For Thread Engagement Group	
N	L
$7H$	$8H$

10.1.2 Tolerances Zones for Pitch Diameter of Bolt Threads

The tolerances zones for pitch diameter, d_2 of bolt threads shall be as specified below:

Tolerances Zones for Pitch Diameter	
For Thread Engagement Group	
N	L
$7h$	$8h$
$7e$	$8e$

10.1.3 Tolerances Zones for Minor Diameter of Nut Threads

The tolerances zones for minor diameter, D_1 of nut threads shall be as specified below:

Tolerances Zones for Minor Diameter	
For Thread Engagement Group	
N	L
$6H$	$7H$

10.1.4 Tolerances Zones for Major Diameter of Bolt Threads

The tolerances zones for major diameter, d_1 of bolt threads shall be as specified below:

Tolerances Zones for Major Diameter	
For Thread Engagement Group	
N	L
$6h$	$7h$
$6e$	$7e$

10.1.5 Tolerances Zones for Minor Diameter, d_3 of Bolt Threads

The tolerances zones for minor diameter of bolt threads, d_3 shall be as specified below:

Tolerances Zones for Minor Diameter	
For Thread Engagement Group	
N	L
$7h$	$8h$
$7e$	$8e$

11 FORMULAE

11.1 Lengths of Thread Engagement

The lengths of thread engagement have been calculated according to the following formulae:

<i>Thread Engagement Group</i>	<i>Lengths of Thread Engagement</i>
<i>N</i>	$2.24 P d^{0.2}$ to $6.7 P d^{0.2}$
<i>L</i>	Over $6.7 P d^{0.2}$
where <i>d</i> is the smallest nominal thread diameter within a series of nominal thread diameters according to 5.	

11.2 Tolerances on Minor Diameter

11.2.1 Tolerances on Minor Diameter of Grade 6 Nut Thread, T_{D1}

These tolerances have been calculated according to the following formula:

$$T_{D1}(6) = 230 P^{0.7}$$

where T_{D1} is, in μm , and P is, in mm.

The Grade 7 tolerances, T_{D1} have been achieved by multiplying the tolerances on the minor diameter of the Grade 6 nut thread by the factor 1.25.

11.2.2 Tolerances on Minor Diameter of Bolt Thread, T_{d3}

The tolerances on the minor diameter, T_{d3} have been calculated from the following formula:

$$T_{d3} = 1.25 T_{d2}$$

where T_{d2} and T_{d3} are in μm (see T_{d2} values from 9.1).

11.3 Tolerances on Major Diameter of Grade 6 Bolt Threads, T_d

These tolerances have been calculated according to the following formula:

$$T_d(6) = 180 (P^2)^{1/3} - \left\{ \frac{3.15}{\sqrt{P}} \right\}$$

where T_d is, in μm and P is, in mm.

The Grade 7 tolerances, T_d have been achieved by multiplying the tolerances on the major diameter of the Grade 6 bolt thread by the factor 1.25.

11.4 Tolerances on Pitch Diameter

11.4.1 Tolerances on Pitch Diameter of Grade 6 Bolt Threads, T_{d2}

These tolerances have been calculated according to the following formula, where d is equal to the geometric mean of the diameters:

$$T_{d2}(6) = 90 P^{0.4} \cdot d^{0.1}$$

where T_{d2} is, in μm , and P and d are, in mm.

The tolerances on pitch diameter, T_{d2} for other tolerance grades have been achieved by multiplying the tolerances on pitch diameter of Grade 6 bolt threads by the factors given below:

<i>Factor for T_{d2} of Bolt Threads</i>		
<i>Tolerance Grade</i>	7	8
<i>Factor</i>	1.25	1.6

11.4.2 Tolerances on Pitch Diameter of Nut Threads, T_{D2}

The tolerances on pitch diameter, T_{D2} have been achieved by multiplying the tolerances on pitch diameter for Grade 6 bolt threads, T_{d2} by the factors given below:

Factor for T_{D2} of Nut Threads

<i>Tolerance Grade</i>	7	8
<i>Factor</i>	1.7	2.12

11.5 Basic Allowances (es)

The basic allowance (es) for tolerance position, $e = -(50 + 11P) \mu\text{m}$.

11.6 Rounding Rules

The values for the tolerances on the major, pitch and minor diameters have been calculated from the formulae given above and then rounded to the nearest value of the R40 series according to IS 1076 (Part 1) to IS 1076 (Part 3).

12 MULTI-START KNUCKLE SCREW THREADS

In the case of multi-start knuckle screw threads, the pitch P (axial distance between two adjacent equidirectional flanks) of the single-start knuckle screw thread has, instead of the lead P , P_h has been taken as the basis for:

- Basic allowances, es
- Tolerances on minor diameter for nut threads, T_{D1} ; and
- Tolerances on major diameter for bolt threads, T_{d1} .

The tolerances on pitch diameter for nut threads, T_{D2} and bolt threads, T_{d2} of the multi-start thread of lead, P (axial displacement for one turn) are increased. For this purpose, the tolerance on pitch diameter for the single-start knuckle screw thread of pitch, P is taken as the basis. These tolerances are multiplied by a factor, correlated to the number of threads from the R20 series according to IS 1076 (Part 1) to IS 1076 (Part 3).

If multi-start threads of large leads are produced, the tolerances, T_{d2} and T_{D2} which cannot be taken from 9.1 and 9.2, the values for T_{d2} and T_{D2} shall be calculated from the formulae given in 11.4.1 and 11.4.2.

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Amendments Issued Since Publication

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